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To: Board of Patent Appeals and Interferences	**From:** Steven L. Nichols
Fax: (571) 273-8300	**Pages:** **27** pages including coversheet
Phone:	**Date:** April 19, 2006
Re: Application No. - **09/821,648**	

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Application No.: 09/821,648 Attorney Docket No.: 40169-0031

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APR 19 2006

40169-0031 **Serial No.: 09/821,648**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application: Zheng J. Geng	**Examiner:** REKSTAD, Erick J.
Application No.: 09/821,648	**Group Art Unit:** 2613
Filed: March 29, 2001	**Conf. No.:** 5727
Title: "Method and Apparatus for Omnidirectional Imaging"	

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application in response to the Notice of Panel Decision for Pre-Appeal Brief Review mailed on **March 20, 2006**.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) **$500.00**.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provision of 37 CFR 1.136 (a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: CFR 1.17(a)-(d)) for the total number of months checked below:

( ) one month $120.00
( ) two months $450.00
( ) three months $1020.00
( ) four months $1590.00

( ) The extension fee has already been filed in this application

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant had inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **18-0013**/40169-0031 the sum of **$500.00**. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 18-0013 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 18-0013 under CFR 1.16 through 1.21 inclusive, and any other section in the Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

(X) I hereby certify that this paper is being transmitted to the Patent and Trademark Office facsimile number **(571) 273-8300** on **April 19, 2006**.

Number of pages: 27

Signature: Rebecca R. Schow

Respectfully submitted,

By:

Steven L. Nichols (Reg. No.: 40,326)
Attorney/Agent for Applicant(s)
Telephone No.: (801) 572-8066
Date: April 19, 2006

40169-0031 09/821,648

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Patent Application of

Zheng J. Geng

Application No. 09/821,648

Filed: March 29, 2001

For: Method and Apparatus for Omnidirectional Imaging

Group Art Unit: 2613

Examiner: REKSTAD, Erick J.

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an Appeal Brief under Rule 41.37 appealing the final decision of the Primary Examiner dated September 21, 2005. Each of the topics required by Rule 41.37 is presented herewith and is labeled appropriately.

I. Real Party in Interest

The real party in interest is Genex Technologies, Inc. of Maryland. The inventor has assigned all rights in the invention and the present application to Genex Technologies, Inc.

II. Related Appeals and Interferences

There are no appeals or interferences related to the present application of which the Appellants are aware.

III. Status of Claims

Claims 1-14 and 16-44 are currently pending in the application and all stand finally rejected. Claim 15 has been cancelled. Appellant appeals from the final rejection of claims 1-14 and 16-44, which claims are presented in the Appendix.

IV. Status of Amendments

On November 21, 2005, Appellant filed one response to the final Office Action mailed on September 21, 2005. However, that response made no amendments to the application. Consequently, its entry into the record has no impact on the content of the claims presented on appeal.

V. Summary of Claimed Subject Matter

A number of approaches had been proposed for imaging systems that attempt to achieve a wide field-of-view (FOV). (Appellant's specification, paragraph 0003). Wide-viewing-angle lens systems, such as fish-eye lenses, are designed to have a very short focal length which, when used in place of conventional camera lens, enables the camera to view

objects at much wider angle to obtain a panoramic view, as shown in Figure 1. In general, to widen the FOV, the design of the fish-eye lens is made more complicated. Moreover, the nonlinear properties resulting from the semi-spherical optical lens mapping make the resolution along the circular boundary of the image very poor. Although the images acquired by fish-eye lenses may be adequate for certain low-precision visualization applications, these lenses still do not provide adequate distortion compensation. (Appellant's specification, paragraph 0004).

To dramatically increase the field of view of an imaging system, Appellant employs a reflective surface to obtain an omnidirectional image. In particular, the field of view of a video camera can be greatly increased by using a reflective surface with a properly designed surface shape that provides a greater field of view than a flat reflective surface. There are a number of surface profiles that can be used to produce an omnidirectional FOV. (Appellant's specification, paragraph 0025).

Figures 2a through 2c appear to indicate that any convex mirror can be used for omnidirectional imaging; however, a satisfactory imaging system must meet two requirements. First, the system must create a one-to-one geometric correspondence between pixels in an image and points in the scene. Second, the convex mirror should conform to a "single viewpoint constraint;" that is, each pixel in the image corresponds to a particular viewing direction defined by a ray from that pixel on an image plane through a single viewing point such that all of the light rays are directed to a single virtual viewing point. Based on these two requirements, the convex mirrors shown in Figures 2a through 2c can increase the field of view but are not satisfactory imaging devices because the reflecting surfaces of the mirrors do not meet the single viewpoint constraint, which is desirable for a high-quality omnidirectional imaging system. (Appellant's specification, paragraph 0026).

The preferred design for a reflective surface is described with reference to Figure 3. Figure 3 shows a video camera 30 having an image plane 31 on which images are captured and a regular lens 32 whose field of view preferably covers the entire reflecting surface of the mirror 34. Since the optical design of camera 30 and lens 32 is rotationally symmetric, only the cross-sectional function z(r) defining the mirror surface cross-section profile needs to be determined. The actual mirror shape is generated by the revolution of the desired cross-section profile about its optical axis. The function of the mirror 34 is to reflect all viewing rays coming from the video camera's 30 focal point C to the surface of physical objects in the field of view. A hyperbola is the preferred cross-sectional shape of the mirror 34 because a hyperbolic mirror will satisfy the geometric correspondence and single viewpoint constraint requirements of the system. (Appellant's specification, paragraph 0027-8).

The image obtained by the camera 30 and capture on the camera's image plane 31 will exhibit some distortion due to the non-planar reflecting surface of the mirror 34. To facilitate the real-time processing of the omnidirectional image, the inventive system uses an algorithm to map the pixels from the distorted omnidirectional image on the camera's image plane 31 onto a perspective window image 40 directly, once the configuration of the perspective or panoramic window is defined. As shown in Figure 4, a virtual perspective viewing window 40 can be arbitrarily defined in a three-dimensional space using three parameters: Zoom, Pan and Tilt. All of these parameters can be adjusted by the user. (Appellant's specification, paragraph 0030).

Once the perspective viewing window W 40 is defined, the system can establish a mapping matrix that relates the pixels in the distorted omnidirectional image I(i,j) to pixels W(p,q) in the user-defined perspective viewing window W 40 to form a non-distorted perspective image. The conversion from the distorted omnidirectional image into a non-

distorted perspective image using a one-to-one pixel correspondence between the two images is unique. (Appellant's specification, paragraph 0031).

Once the mapping matrix MAP has been established, the real-time image-processing task is greatly simplified and can be conducted in a single step at step 70 by applying the mapping matrix MAP to each pixel I(i,j) in the omnidirectional image I to determine the pixel values for each corresponding pixel in the perspective viewing window W. Further, each time a new omnidirectional image I is acquired, a look-up table operation can be performed to generate the non-distorted perspective image for display in the perspective viewing window W at step 72. (Appellant's specification, paragraph 0036).

VI. Grounds of Rejection to be Reviewed on Appeal

In the final Office Action, the following rejections were made for which review is requested by this appeal.

(1) Claims 1-6 were rejected as unpatentable under 35 U.S.C. § 103(a) in view of the combined teachings of U.S. Patent No. 6,118,474 to Nayar ("Nayar") and U.S. Patent No. 5,870,135 to Glatt et al. ("Glatt").

(2) Claims 14 and 16-23 were rejected as being unpatentable under 35 U.S.C. § 103(a) in view of the combined teachings of Nayar and U.S. Patent No. 4,908,874 to Gabriel ("Gabriel").

(3) Claims 31-38 and 44 were rejected as unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Gabriel and U.S. Patent No., 6,226,035 to Korein et al. ("Korein").

(4) Dependent claims 7-9 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Nayar and U.S. Patent No. 5,790,181 to Chahl et al ("Chahl") and U.S. Patent No. 3,988,533 to Mick et al. ("Mick").

(5) Dependent claims 10-13 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Glatt and U.S. Patent No. 5.686,975 to Baker ("Baker").

(6) Dependent claims 24 and 25 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Gabriel, Chahl and Mick.

(7) Dependent claims 26-29 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Gabriel, and Baker.

(8) Dependent claim 39 and 40 were rejected as unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Gabriel, Korein, Chahl and Mick.

(9) Dependent claim 41-43 were rejected as unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Gabriel, Korein, and Baker.

VII. Argument

Claim 1:

Claims 1-6 were rejected as unpatentable under 35 U.S.C. § 103(a) in view of the combined teachings of U.S. Patent No. 6,118,474 to Nayar ("Nayar") and U.S. Patent No. 5,870,135 to Glatt et al. ("Glatt").

Claim 1 recites:

> A method for generating a selectable perspective view of a portion of a hemispherical image scene, comprising the steps of:
> acquiring an omnidirectional image on an image plane using a reflective mirror that satisfies a single viewpoint constraint and an image sensor;
> defining a perspective viewing window based on configuration parameters; and

mapping each pixel in the perspective window with a corresponding pixel value in the omnidirectional image on the image plane using a look-up table based on the configuration parameters.

Nayar is cited because Nayar teaches the collection of a wide-angle image using a truncated, substantially paraboloid-shaped reflector." (Nayar, abstract). However, in /contrast to claim 1, Nayar fails to teach or suggest the claimed mapping of pixels from an omnidirectional image to a perspective viewing window "using a look-up table." The recent Office Action concedes this point (Action of 9/21/05, p. 2, "Nayar is lacking the use of look-up tables for the mapping.")

Consequently, the Office Action proposed to combine the teachings of Glatt with Nayar. According to the Office Action, "Glatt teaches the mapping from a fish-eye lens (which is hemispherical) to cartesian coordinates using a look-up table." (Action of 9/21/05, p. 2). Glatt describes in detail the equations that are used to map the image from the fish-eye lens. (Glatt, col. 7, line 46 to col. 8, line 43). Glatt, however, does not teach or suggest how mapping would be performed using a look-up table for an image that comes, not from a fish-eye lens, but from a reflective mirror as claimed.

The mapping function of Glatt cannot be imported into the system taught by Nayar because Nayar does not operate on an image produced with a fish-eye lens. The vast differences between the use of a mirror and a fish-eye lens and the problems associated with the use of a fish-eye lens are documented in Appellant's specification at, for example, paragraph 0004 as noted in the Summary of Claimed Subject Matter above..

"An analysis of obviousness of a claimed combination must include consideration of the results achieved by that combination." *Gillette Co. v. S.C. Johnson & Son, Inc.*, 919 F.2d 720 (Fed. Cir. 1990). "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings

of the references are not sufficient to render the claims prima facie obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)." M.P.E.P. § 2143.01.

More importantly, "[i]n order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and use the apparatus or method." Beckman *Instruments, Inc. v. LKB Produkter AB*, 892 F.2d 1547, 1551, 13 U.S.P.Q.2d 1301, 1304 (Fed. Cir. 1989); *In re Payne*, 606 F.2d 303, 314, 203 U.S.P.Q. 245, 255 (CCPA 1979). In the present case, the teachings of Nayar and Glatt, even if combined, do not enable one of skill in the art to make and use the claimed method in which a look-up table is used to map an image from a reflective mirror, rather than from a fish-eye lens.

For any and all of these reasons, the teachings of Nayar and Glatt fail to enable or render obvious the subject matter of claim 1. Therefore, the rejection of claim 1 and its dependent claims based on Nayar and Glatt should not be sustained.

Claim 2, 3, 18, 19, 34 and 35:

The various dependent claims in the application recite further subject matter that is not taught or suggested by the prior art of record. For example, claim 2 recites:

> wherein the configuration parameters defined in the defining step include at least one of a zoom distance defined as the distance from the focal point of said reflective mirror to said window, a pan angle defined as the angle between the x axis and a line through the focal point of said reflective mirror perpendicular to the x-y plane and a tilt angle defined as the angle between the x-y plane and a vector normal to said window.

Claims 18 and 34 recite similar subject matter.

In contrast, Nayar and Glatt fail to teach or suggest the claimed configuration parameters including a zoom distance defined as the distance from the focal point of a

reflective mirror to a user-defined window, a pan angle and tilt angle as claimed. For at least this additional reason, the rejection of claims 2, 3, 18, 19, 34 and 35 should not be sustained.

Claims 4, 5, 20 and 36:

Claim 4 recites:

> wherein the mapping step includes the step of generating a mapping matrix by:
> applying a ray tracing algorithm to each pixel in the perspective viewing window to determine a corresponding reflection point on the reflective mirror; and
> projecting each reflection point to a focal point of the image sensor to determine the corresponding location in the omnidirectional image on the image plane.

Claims 20 and 36 recite similar subject matter.

In contrast, Nayar and Glatt, as demonstrated above, teach mapping from a fish-eye lens. Consequently, Nayar and Glatt cannot and do not teach or suggest a method having a mapping step that includes applying a ray tracing algorithm to each pixel in the perspective viewing window to determine a corresponding reflection point on the reflective mirror as claimed. For at least this additional reason, the rejection of claims 4, 5, 30 and 36 should not be sustained.

Claims 14, 16-23, 31-38 and 44:

Claims 14, 16-23, 31-38 and 44 were rejected as being unpatentable under 35 U.S.C. § 103(a) in view of the combined teachings of Nayar and U.S. Patent No. 4,908,874 to Gabriel ("Gabriel"). For at least the following reasons, this rejection is respectfully traversed.

Claim 14 recites:

> An improved imaging apparatus for generating a two-dimensional image, comprising:
> a reflective mirror configured to satisfy an optical single viewpoint constraint for reflecting an image scene;

> an image sensor responsive to said reflective mirror and that generates two dimensional image data signals to obtain an omnidirectional image on an image plane; and
>
> a controller coupled to the image sensor, wherein the controller defines a perspective viewing window based on configuration parameters and maps pixels from said omnidirectional image into said perspective viewing window; and
>
> *a memory for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space, said controller using a said mapping matrix to perform mapping of pixels from said omnidirectional image into said perspective viewing window.*

(emphasis added).

Claims 31-38 and 44 were rejected as unpatentable under 35 U.S.C. § 103(a) over the combined teachings of Nayar, Gabriel and U.S. Patent No., 6,226,035 to Korein et al. ("Korein").

Similar to claim 14, claim 31 recites:

> An imaging apparatus for generating a two-dimensional image, comprising:
>
> a reflective hyperbolic mirror having a hyperbolic cross-section;
>
> an image sensor optically coupled to said reflective mirror that generates two-dimensional image data signals based on an omnidirectional image reflected by said mirror; and
>
> a controller coupled to the image sensor, wherein the controller defines a perspective viewing window based on configuration parameters and maps pixels from said omnidirectional image into said perspective viewing window; and
>
> a memory for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space, said controller using a said mapping matrix to perform mapping of pixels from said omnidirectional image into said perspective viewing window.

As conceded in the Office Action, "Nayar does not specifically teach the memory for storing a mapping matrix for each of a plurality of sets of said configuration parameters in parameter space." (Action of 9/21/05, p. 10). Consequently, the Office Action cites to Gabriel, which allegedly teaches "the use of matrices to perform transformations such as translation, contraction, expansion rotation and perspective projection." (*Id.*). Applicant respectfully submits that even if this interpretation of Gabriel's teachings is accurate, it is insufficient to support a rejection of claim 14.

Gabriel does not teach or suggest "a memory for storing a mapping matrix *for each of a plurality of sets of said configuration parameters in a parameter space*." The Office Action fails to indicate how or where Gabriel or any other cited prior art reference teaches or suggests a memory storing a mapping matrix *for each of a plurality of sets of configuration parameters*. The final Office Action does not even expressly allege that Gabriel teaches this subject matter.

Moreover, the Office Action states that the teachings of Gabriel are applicable "to perform complex warping of images such as to a fish-eye image." (Action of 9/21/05, p. 3). As demonstrated above, this further proves the inapplicability of the teachings of Gabriel to claim 14, which calls for a method using an omidirectional image acquired with a "reflective mirror." The teachings of Gabriel cannot be applied to a method in which mapping is performed using an image from a reflective mirror rather than a fish-eye lens.

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). For at least these reasons, the rejection of claim 14 and its dependent claims and claims 31-38 and 44 should not be sustained.

Claim 38:

Claim 38 recites: "The imaging apparatus of claim 31, wherein said memory contains a predetermined mapping matrix for every set of configuration parameters in said parameter space." In contrast, the combination of Nayar, Gabriel and Korein fails to teach or suggest the claimed memory containing a predetermined mapping matrix for every set of

configuration parameters in a parameter space. For at least this additional reason, the rejection of claim 38 should not be sustained.

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the Final Rejection of September 21, 2005 is respectfully requested.

Respectfully submitted,

DATE: April 19, 2006

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VIII. CLAIMS APPENDIX

1. (previously presented) A method for generating a selectable perspective view of a portion of a hemispherical image scene, comprising the steps of:

acquiring an omnidirectional image on an image plane using a reflective mirror that satisfies a single viewpoint constraint and an image sensor;

defining a perspective viewing window based on configuration parameters; and

mapping each pixel in the perspective window with a corresponding pixel value in the omnidirectional image on the image plane using a look-up table based on the configuration parameters.

2. (original) The method of claim 1, wherein the configuration parameters defined in the defining step include at least one of a zoom distance defined as the distance from the focal point of said reflective mirror to said window, a pan angle defined as the angle between the x axis and a line through the focal point of said reflective mirror perpendicular to the x-y plane and a tilt angle defined as the angle between the x-y plane and a vector normal to said window.

3. (original) The method of claim 2, wherein the defining step is conducted via a user interface through which a user enters data corresponding to at least one of a desired zoom distance, pan angle, or tilt angle.

4. (original) The method of claim 1, wherein the mapping step includes the step of generating a mapping matrix by:

applying a ray tracing algorithm to each pixel in the perspective viewing window to determine a corresponding reflection point on the reflective mirror; and

projecting each reflection point to a focal point of the image sensor to determine the corresponding location in the omnidirectional image on the image plane.

5. (original) The method of claim 4, further comprising the step of storing the mapping matrix in a module having a memory.

6. (original) The method of claim 1 wherein the step of defining a perspective viewing window defines the perspective viewing window as a panoramic viewing window.

7. (original) The method of claim 1, further comprising the steps of:

calculating a residual image based on a difference between a reference omnidirectional image and a sequential omnidirectional image;

determining if the residual image contains any value that exceeds a predetermined threshold; and

classifying any value that exceeds the predetermined threshold as an anomaly.

8. (original) The method of claim 7, further comprising the steps of:

calculating the configuration parameters for the perspective viewing window from the anomaly; and

selectively focusing the perspective viewing window on the anomaly using the calculated configuration parameters.

9. (original) The method of claim 7, further comprising the step of activating an alarm if at least a portion of the residual image exceeds a predetermined threshold.

10. (original) The method of claim 1, further comprising the steps of:

detecting a location of a sound source in the image scene; and

adjusting the perspective viewing window based on the detected location of the sound source.

11. (original) The method of claim 1, further comprising the step of transmitting the omnidirectional image via the Internet.

12. (original) The method of claim 11, wherein the transmitting step is conducted through a server that receives the omnidirectional image and transmits the omnidirectional image to at least one client.

13. (original) The method of claim 1, further comprising the step of forming a two-way transmission link between the image sensor and a remote display, wherein the two-way transmission link transmits at least one of the omnidirectional image, the perspective viewing window, and an audio signal.

14. (previously presented) An improved imaging apparatus for generating a two-dimensional image, comprising:

a reflective mirror configured to satisfy an optical single viewpoint constraint for reflecting an image scene;

an image sensor responsive to said reflective mirror and that generates two dimensional image data signals to obtain an omnidirectional image on an image plane; and

a controller coupled to the image sensor, wherein the controller defines a perspective viewing window based on configuration parameters and maps pixels from said omnidirectional image into said perspective viewing window; and

a memory for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space, said controller using a said mapping matrix to perform mapping of pixels from said omnidirectional image into said perspective viewing window.

15. (cancelled).

16. (original) The improved imaging apparatus of claim 14, wherein the reflective mirror creates a one-to-one correspondence between pixels in the omnidirectional image and pixels in the perspective viewing window.

17. (original) The improved imaging apparatus of claim 14, wherein the controller maps the omnidirectional image to the perspective viewing window by mapping each pixel in the perspective viewing window with a corresponding pixel value in the omnidirectional image.

18. (original) The improved imaging apparatus of claim 14, wherein the parameters defining the perspective viewing window include at least one of a zoom distance defined as the distance from the focal point of said reflective mirror to said window, a pan angle defined as the angle between the x axis and a line through the focal point of said reflective mirror perpendicular to the x-y plane and a tilt angle defined as the angle between the x-y plane and a vector normal to the perspective viewing window.

19. (original) The improved imaging apparatus of claim 18, further comprising a user interface through which a user enters data corresponding to at least one of a desired zoom distance, pan angle, or tilt angle.

20. (previously presented) The improved imaging apparatus of claim 14, wherein the controller generates a mapping matrix by applying a ray tracing algorithm to each pixel in the perspective viewing window to determine a corresponding reflection point on the reflective mirror and then projecting each reflection point to a focal point of the image sensor to determine the corresponding location on the omnidirectional image.

21. (original) The improved imaging apparatus of claim 14, wherein the perspective viewing window is a panoramic viewing window.

22. (previously presented) The improved imaging apparatus of claim 14, further comprising a module having a memory for storing a mapping matrix.

23. (original) The improved imaging apparatus of claim 22, wherein the module is a display/memory/local control module.

24. (original) The improved imaging apparatus of claim 14, wherein the controller calculates a residual image based on a difference between a reference omnidirectional image and a sequential omnidirectional image to detect an anomaly and uses the anomaly to calculate parameters for the perspective viewing window so that the perspective viewing window focuses on the anomaly.

25. (original) The improved imaging apparatus of claim 24, further comprising an alarm that is activated if at least a portion of the residual image exceeds a predetermined threshold.

26. (original) The improved imaging apparatus of claim 14, further comprising an acoustic sensor coupled to the controller for detecting a sound source within the image scene, wherein the controller adjusts the perspective viewing window based on a location of the sound source.

27. (original) The improved imaging apparatus of claim 14, further comprising an image transmission system for transmitting the omnidirectional image via the Internet.

28. (original) The improved imaging apparatus of claim 27, wherein the image transmission device includes a server that receives the omnidirectional image and transmits the omnidirectional image to at least one client.

29. (previously presented) The improved imaging apparatus of claim 14, further comprising:

a remote display coupled to the image sensor;

a first speaker and first microphone coupled to the image sensor; and

a second speaker and second microphone coupled to the remote display, wherein the first and second speakers and first and second microphones form a two-way transmission link between the image sensor and the remote display.

30. (previously presented) The improved imaging apparatus of claim 14, wherein said reflective mirror is a hyperbolic mirror having a hyperbolic cross-section.

31. (previously presented) An imaging apparatus for generating a two-dimensional image, comprising:

a reflective hyperbolic mirror having a hyperbolic cross-section;

an image sensor optically coupled to said reflective mirror that generates two-dimensional image data signals based on an omnidirectional image reflected by said mirror; and

a controller coupled to the image sensor, wherein the controller defines a perspective viewing window based on configuration parameters and maps pixels from said omnidirectional image into said perspective viewing window; and

a memory for storing a mapping matrix for each of a plurality of sets of said configuration parameters in a parameter space, said controller using a said mapping matrix to perform mapping of pixels from said omnidirectional image into said perspective viewing window.

32. (previously presented) The imaging apparatus of claim 31, wherein the reflective mirror creates a one-to-one correspondence between pixels in the omnidirectional image and pixels in the perspective viewing window.

33. (previously presented) The imaging apparatus of claim 31, wherein the controller maps the omnidirectional image to the perspective viewing window by mapping each pixel in the perspective viewing window with a corresponding pixel value in the omnidirectional image.

34. (previously presented) The imaging apparatus of claim 14, wherein parameters defining the perspective viewing window include at least one of a zoom distance defined as the distance from the focal point of said reflective mirror to said window, a pan angle defined as the angle between the x axis and a line through the focal point of said reflective mirror perpendicular to the x-y plane and a tilt angle defined as the angle between the x-y plane and a vector normal to the perspective viewing window.

35. (previously presented) The imaging apparatus of claim 34, further comprising a user interface through which a user enters data corresponding to at least one of a desired zoom distance, pan angle, or tilt angle.

36. (previously presented) The imaging apparatus of claim 31, wherein the controller generates a mapping matrix by applying a ray tracing algorithm to each pixel in the perspective viewing window to determine a corresponding reflection point on the reflective mirror and then projecting each reflection point to a focal point of the image sensor to determine the corresponding location on the omnidirectional image.

37. (previously presented) The imaging apparatus of claim 31, wherein the perspective viewing window is a panoramic viewing window.

38. (previously presented) The imaging apparatus of claim 31, wherein said memory contains a predetermined mapping matrix for every set of configuration parameters in said parameter space.

39. (previously presented) The imaging apparatus of claim 31, wherein the controller calculates a residual image based on a difference between a reference omnidirectional image and a sequential omnidirectional image to detect an anomaly and uses the anomaly to calculate parameters for the perspective viewing window so that the perspective viewing window focuses on the anomaly.

40. (previously presented) The imaging apparatus of claim 39, further comprising an alarm that is activated if at least a portion of the residual image exceeds a predetermined threshold.

41. (previously presented) The imaging apparatus of claim 31, further comprising an acoustic sensor coupled to the controller for detecting a sound source within a scene of said omnidirectional image reflected by said mirror, wherein the controller adjusts the perspective viewing window based on a location of the sound source.

42. (previously presented) The imaging apparatus of claim 31, further comprising an image transmission system for transmitting image output by said image sensor via the Internet.

43. (previously presented) The imaging apparatus of claim 31, further comprising:

a remote display coupled to the image sensor;

a first speaker and first microphone coupled to the image sensor; and

a second speaker and second microphone coupled to the remote display,

wherein the first and second speakers and first and second microphones form a two-way transmission link between the image sensor and the remote display.

44. (previously presented) The imaging apparatus of claim 31, wherein

each said mapping matrix is configured to reduce distortion during mapping of each pixel in the perspective viewing window with a corresponding pixel from said omnidirectional image.

IX. Evidence Appendix

None

X. Related Proceedings Appendix

None

XI. Certificate of Service

None